fiber going to the neighborhood where the subscriber resides. At the subscriber's residence, a large number of signals are present simultaneously. These signals might serve up to 500 subscribers who share that same node. The subscriber's equipment selects the correct part of the spectrum, tunes it, demultiplexes the digital signal that is addressed to that individual subscriber and then decompresses it. All this is accomplished with a minimum of hardware strategically located to minimize the cost of the network and maximize its efficiency, flexibility, and utilization. A critical part of this approach is that multiple signals share the same physical path. This dramatically reduces costs. On the other hand, it also means that the security of those signals is very important. The ability to deliver a secure signal to an individual subscriber depends on other subscribers

switched signals are converted to NTSC form in the home for addition to the mix of analog signals received.

This is just one example of the many methods being investigated and developed for implementation on switched broadband networks. The technology is rich in choices and opportunities. But broadband switching will not diminish the consumer electronics compatibility problems identified in the 1992 Cable Act.

III. CABLE ACT PRESSURES FOR SCRAMBLING

Section 624A(b)(1) of the 1992 Cable Act directs the Commission to issue a report to Congress by October, 1993 on means of assuring compatibility between cable and certain features offered by high-end consumer electronics equipment, "consistent with the need to prevent theft of cable service." Within 180 days thereafter, the Commission is directed to adopt "such regulations as are necessary to assure such compatibility." In adopting such regulations, the Commission is directed to:

> determine whether, and if so under what circumstances, to permit cable systems to scramble or encrypt signals . . . .[21]

Equally important, the Commission is directed to attempt to achieve compatibility between certain functions of consumer electronics equipment and cable:

> while providing effective protection against theft or unauthorized reception of cable service . . . .[22]

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[21]Section 624A(b)(2).

[22]Section 624A(c)(1)(A).

Moreover, in so doing, the Congress expressly directed the Commission to consider:

> the need for cable operators to protect the integrity of the signals transmitted by the cable operator

consent broadcasters may be non-contiguous and cable operators may be forced to change the channels on a periodic basis. These requirements exert pressure on cable operators to discontinue the use of traps for providing signal security and move to flexible methods such as scrambling for several reasons.

Initially, because broadcast stations asserting must-carry rights apparently will have discretion to choose their channel positioning from among the statutory available alternatives,[26] this may prevent operators from placing all basic services on contiguous channels which would allow for the simple use of the single trap to secure the upper tiers from the basic service. As noted previously, there are practical, mechanical and electronic concerns which drastically limit the number of traps which can be used on any single cable drop.

The situation is further exacerbated by the fact that stations carried pursuant to must-carry and retransmission consent may change their election every three years. Accordingly, channels which are not presently used to carry broadcast signals may be required to be set-aside for that purpose during a subsequent triennial election. Moreover, even after a triennial election is made, there is the possibility that a new station coming on the air may assert must-carry rights which would require accommodation of that station on the system's basic tier. Because traps are static, the addition of new

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[26]See Sections 614(b)(6); 615(g)(5).

channels or the changing of channel assignments to accommodate must-carry, retransmission consent and channel positioning rights would require the operator to replace traps each time such a change was required. The replacement of traps is both costly and labor intensive, not to mention the fact that the operator's investment in that equipment has now been negated since the equipment most probably cannot be reused on the system.

Accommodation of security concerns in a fluid environment such as that presented by must-carry and retransmission consent can better be accomplished with scrambling that can be controlled from the headend location. In such cases, new stations may be added and the scrambling changes may be effected without the need to engage in a service call to every affected subscriber's home. The significant cost savings and operational ease of addressable scrambling in such an environment make it an attractive and far superior alternative.

B. Anti Buy-through

The purpose of the anti buy-through provision is to allow basic tier subscribers to have access to premium and pay-per-view services without having to buy through additional service tiers. In a trapped system, implementation of anti buy-through will require placement of the premium and pay-per-view channels on frequencies which the trap will pass into the home. Each premium service will have to be individually controlled since not all basic subscribers will desire to purchase all premium services.

This requires a complex trapping scheme that will allow different combinations of premium services to be ordered.

Several problems are associated with any such trapping scheme. First, the practical, mechanical and electronic limitations to the number of traps which may be used on any particular cable drop effectively limits the number of premium services that can be offered. Thus, newly developing premium services which may be offered in the future may not be able to be accommodated on the system which uses traps. Second, newly developing services such as multi-channel IPPV and NVOD, which require a large number of channels, can only be affectively implemented with addressability and descrambling. Traps will not be practical in most situations.

Similarly, technology such as interdiction, while more flexible than traps, does not have the channel capacity to handle all the channels which must be controlled in a secure manner in modern cable systems under these new statutory requirements. Interdiction would have been much more practical in a world with just a few channels protected and the rest in the clear. That was a world without a basic service tier, without must-carry and channel positioning and without anti-buy through requirements.

because scrambling is the most practical way to effectuate many of the provisions of the 1992 Cable Act. Accordingly, the FCC must take these factors into account in implementing its compatibility regulations and should not prevent cable operators from utilizing scrambling to accomplish these goals.

IV. IMPROVING COMPATIBILITY

A. Existing TVs and VCRs

As alluded to earlier, even in cable systems which employ scrambling, substantial compatibility can be achieved in a cost effective manner that minimizes the cost to subscribers while maximizing the utility of the special functions of their TVs and VCRs. This can be done in concert with the need to provide signal security and offer the subscriber the opportunity to make choices.

Section 624A(c)(1)(A) of the 1992 Cable Act delineates the three areas of concern with respect to cable/consumer equipment compatibility. These are the subscribers ability:

(i) to watch a program on one channel while simultaneously using a video cassette recorder to tape a program on another channel;

(ii) to use video cassette recorder to tape two consecutive programs that appear on different channels; and

(iii) to use advanced television picture generation and display features.

In many cases this functionality is substantially available. In other cases, it can be provided at modest optional cost to the subscriber. Indeed, the subscriber should make the value

judgment and choose what is best for his situation. Some typical examples are outlined below.

1. Basic Service Tier Only: In the vast majority of cable systems, the basic service tier channels are left unscrambled. Only in rare cases is the theft of service problem so severe that even the basic service tier must be scrambled. When the basic service tier is unscrambled, those subscribers who only take that tier have as much functionality as over-the-air

2. Basic Service Tier with Premium or Pay-Per-View:

When the basic service tier subscriber decides to take a premium channel or a pay-per-view channel, several choices exist:

(a) Accept some limitations on the functionality of existing (or new, lower cost) consumer electronics equipment as a worthwhile trade off for having access to expanded programming.

(b) Purchase new consumer electronics equipment with features such as the Decoder Interface Connector (discussed below) which make scrambling transparent.

(c) Rent (or purchase) supplementary equipment which improves the compatibility of the hardware with the cable service.

The simplest supplementary hardware option which the subscriber could rent (or purchase) for this situation is a decoder by-pass switch.[27] When the subscriber is watching the unscrambled basic service tier channels, the cable signal is by-passed around the descrambler and he enjoys full functionality of his TV or VCR. This is also true if the premium channel he takes is protected by traps. If the trapped channel passes through the basic service tier, it will be available to his TV or VCR. When he wishes to watch a scrambled premium channel or pay-per-view channel, the by-pass switch is turned off and the descrambler's output channel is tuned by the TV or VCR. While in this mode, there are some minimal limitations on his consumer electronics features, as described below.

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[27]Such switches are readily available commercially and are advertised in a number of widely circulated catalogues. See, e.g., Appendix 2.

3. Other tiers: If the subscriber wishes still other tiers of service and his TV and/or VCR are capable of tuning these channels without impairment, substantially all of the functionality listed by the Cable Act can be achieved at modest cost to the subscriber.

With respect to being able to record consecutive programs that appear on different channels, the solution is straight forward. All current vendors of descramblers have models which include timers which change channels. The subscriber who is capable of programming a VCR can use exactly the same skills to program the converter/descrambler and accomplish this result. The limiting factor here is the ability to program the VCR. If the subscriber cannot program his VCR, the point is moot.

In addition, there are other products available which perform the same function. For example, after-market universal remote controls are available which include built-in timers. Similarly, the popular "VCR Plus" product in its original component form controls both VCRs and cable converters with IR signals emitted at the correct time to change converter channels and turn on the VCR.[28] Although the VCR Plus does require a fairly complicated initial setup procedure, after its initiation, a simple string of numbers available from the printed program guide is entered to "program" the unit to sequentially record different programs on different channels. Thus, the recording of

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[28]VCR Plus units are readily available commercially. See Appendix 2.

consecutive programs on different channels can be accommodated in several ways.

The ability to view one program while recording another and to use PIP features offered by certain consumer electronics equipment can also be accommodated in scrambled systems. Supplementary equipment is required to accomplish this. This equipment consists of either a second converter/descrambler or two converter/descramblers in one cabinet. In either case, the subscriber must decide that this increased access is worth the extra cost of supplementary equipment. Again, the choice rightly belongs to the subscriber. To force extra cost on all subscribers when just a few may desire it is not in the public interest.

All of these techniques have been implemented in some cable systems. Until recently, there has been negligible demand for them. At present the demand is still small. Perhaps the most important reason for the limited deployment has been a lack of awareness on the part of subscribers. The 1992 Cable Act mandates the Commission to issue regulations that, inter alia, require cable operators to notify the cable subscribers of certain potential incompatibility problems.[29] Time Warner fully intends to comply with these requirements and believes that aggressive notification will go a long way to eliminate the incompatibility problem by attacking its main cause -- the lack

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[29]See Section 624A(c)(2)(B).

of consumer awareness. It would help if the consumer electronics industry included information on these techniques in its sales training programs for retailers. As discussed more fully in Section VI, the FCC may want to consider implementing regulations that would require notification and education of consumers as to compatibility issues and alternatives by the consumer electronics industry at the point of sale. Making consumers aware of these matters before they make an incompatible electronics equipment purchase is far preferable to eliminating choice and diversity by restricting cable service or security techniques.

B. New TVs And VCRs

A very different situation exists where the subscriber decides to purchase new equipment. Frustration and disappointment are maximized when a proud new purchase is brought home and unexpected compromises must be made. This does not have to be the case. The new purchase is an opportunity to make significant progress toward compatibility.

A critical need exists for technical standards for "Cable Ready" TVs and VCRs. An important part of that standard is a component descrambler interface, sometimes referred to as a Decoder Interface Connector. This interface, which is built into the TV or VCR allows the cable operator to install a component descrambler downstream from the TV's or VCR's tuner and returns full functionality of the remote control and tuning functions to the subscriber. It makes scrambling transparent. As discussed more fully in subsection C below, the industry technical standard

for the component descrambler interface is called the EIA/ANSI 563. If the cable television and consumer electronics industries fully supported it, the EIA/ANSI 563 standard would offer an attractive option when purchasing new TVs or VCRs to the approximately twenty million households which Paul Kagan estimates currently have addressable analog descramblers in place.[30]

A frustrating recent example of the way in which otherwise compatible consumer electronics products, absent federal standards, can be implemented in a manner which makes them incompatible with cable is seen in the introduction of some VCRs where "VCR Plus" technology has been built in to the VCR equipment in a manner that does not allow the VCR Plus to control cable boxes as well as the VCR. The original "VCR Plus" product is a component device which looks like a remote control. It has a built-in timer and clock and can be programmed to emit the correct infrared signals to control both a VCR and any attached cable converter so that programs on different channels can be recorded sequentially regardless of whether or not the VCR is connected to a cable system. There is no further need to set the VCR's timer. Most brands of VCRs have now been introduced with the "VCR Plus" technology already built-in as an added feature. However, unlike VCR Plus in its original component form (which is still available), the VCR Plus feature built into the various

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[30]Paul Kagan Associates, Inc., Cable TV Technology, January 31, 1993, p.3.

brands of consumer electronics equipment, with few exceptions,

integrated converter/descrambler. Fortunately, even integrated converter/descramblers can be implemented in ways which are substantially non-interfering with consumer electronics features.

"MultiPort" has been the commonly used name for the technical standard for the connection of descramblers to the backs of TVs and VCRs that are equipped with a special plug. It is not an official name and the continued use of this name is discouraged. The standard was developed and tested over a period of several years by engineers from the cable and consumer electronics industries. The Joint Engineering Committee that did the work is sponsored by the Electronic Industries Association ("EIA") and the Engineering Committee of the National Cable Television Association ("NCTA"). The standard developed by the EIA/NCTA Joint Engineering Committee was submitted to the American National Standards Institute ("ANSI") and is now formally known as "The EIA/ANSI 563 Decoder Interface Standard." It is interesting to note that in over ten years of deliberations, this is the only standard ever agreed to between the two industries!

The nickname "MultiPort" comes from the original intention of the Joint Engineering Committee to develop a standard that would have multiple applications in the consumer, cable, computer, and other related video fields. At one time, the standard was referred to as "IS-15." This was while it was an "Interim Standard." It is no longer interim. It is a fully

negotiated and accepted technical standard between the engineers of the two industries.

The Decoder Interface Connector plug has 20 pins and looks somewhat like the plugs on the back of computers. It allows access to the internal circuitry of television receivers and VCRs in a manner that facilitates the operation of descrambler circuits. The video and audio signals go into and out of the television receiver or VCR and then into and out of the descrambler. This same twenty pin plug is mandated on TVs in France and much of the rest of Europe. It also appears on many TVs sold in Japan. The mechanics are identical, but the electrical connections are different. It is ironic that in the United States, the country with the most cable and cable decoders, this plug is not in extensive use. It is only required in countries which have little need for it!

An optional enhancement allows the TV's or VCR's remote control to communicate with the descrambler and the descrambler to communicate with the tuner in the TV or VCR. This means that IPPV ordering with the TV's or VCR's remote control is accommodated. Because video signals exit and enter the Decoder Interface Connector, such functions as OSDs, for assisting the subscriber in ordering IPPV and for electronic program guides are possible. In fact, because the video signals do not have to go through the tuner of the television receiver, the OSD will be much crisper and easier to read. Other text and graphics services can also be implemented in external modules for clear

display on the TV screen. Furthermore, it is possible to connect multiple devices to a TV or VCR so that, for example, a closed captioning decoder and a cable descrambler can be both used.

There are two other interesting applications of the Decoder Interface Connector which should be emphasized. First, the EIA/ANSI 563 plug can be used to easily connect TVs and VCRs without the need for multiple cables for video and audio in and out and left and right. This is much simpler and less confusing

"remodulator" to condition the signal so it is acceptable to the TV or VCR tuner. Not only do these missing items save money and consume less power, they reduce the "bruising" the signal undergoes as it is unnecessarily processed in the conventional set-top descrambler. All of these factors will result in lower costs and significantly higher reliability. The latter advantage comes from two factors: there are fewer components to fail and the amount of heat and power consumption is significantly reduced. Heat is the main killer of electronic components.

1. The Decoder Interface Connector With VCRs: The Decoder Interface Connector makes the most sense when installed on a VCR for several reasons:

- VCRs have the most difficulty with a set-top unit since the VCR cannot control the channel being recorded in this configuration. If the Decoder Interface Connector is used, the VCR's timer regains control of the VCR's tuner and sequential recording of different channels again becomes easy. Otherwise, a duplicate timer in the set-top must also be programmed to sequentially record from different channels.

- If the Decoder Interface Connector unit is only on the TV, the TV must be left powered in order to provide signals to the Decoder Interface Connector unit plugged into it so that the VCR has descrambled signals to record. Consumers are often reluctant to leave a TV powered when they aren't home. This is probably because of a sense of economy regarding waste of electricity or

[redacted]

- Consumers are more likely to have two VCRs in one room than two TVs. The new VCR could be Decoder Interface Connector equipped. In addition, other rooms in the home may have TVs but are less likely to have VCRs. An older VCR still can be used elsewhere when it is replaced with a new Decoder Interface Connector equipped model.

Having the Decoder Interface Connector on the VCR allows sequential recording of programs from different channels with no more complication than using the VCR with an antenna. The Decoder Interface Connector makes the scrambling transparent.

2. Picture-In-Picture: There are two kinds of PIP features. The first simply places a small picture inside of the larger picture. Sound comes only from the larger picture. A button on the remote control allows the exchange of the two pictures. The second type of PIP cycles the tuner through twelve channels repeatedly displaying still pictures captured from each channel into a four by three matrix on the screen. This acts as a sort of program guide allowing the viewer to see what is on twelve favorite channels simultaneously in order to make a selection.

It should be understood that the majority of TV receivers with PIP do not come with two tuners. The second picture comes from baseband video and audio inputs on the back of the TV set. These inputs are fed from either a separately purchased camcorder or VCR. When a VCR is used, its tuner provides the channel selection for the second PIP picture. One picture comes via the TV tuner and is selected by its tuner and remote control. The second picture comes via the VCR's tuner and is chosen with its

tuner and remote control. If PIP is to be used for two scrambled channels, the TV and the VCR both require descramblers. Likewise, in the few situations where the PIP TV has two tuners, two Decoder Interface Connectors are required for PIP to work with two scrambled channels. The Decoder Interface Connector

Interface Connector on their next purchase of a TV receiver or VCR. This is a number which grows every year. Pressures from the Cable Act and the demand for multichannel IPPV will accelerate this growth. When a particular scrambling technology is installed in a cable system, it is intended to remain in place for ten to fifteen years, absent substantial defeat by pirates. This is because the capital investment and the commitment to training, inventory, etc. is huge. Almost certainly, any technological advances which occur in the next several years will not change this. These advances will be applied to older systems needing to be upgraded. Currently, the only electronic signal protection technology being purchased in volume for use in cable is analog based scrambling which can benefit from the Decoder Interface Connector. This will remain the case for the foreseeable future.

Similarly, HDTV technology is also at least a few years away from implementation. Because of the high cost of HDTV receivers, it is likely that penetration of HDTV receivers and VCRs will take years. It is probable that HDTV penetration will lag the penetration of digital video compression units. Furthermore, an industry committee is working on a version of the Decoder Interface Connector for HDTV/Advanced Television.

Like HDTV, video compression is a promising digital technology. Initially, video compression products will be expensive. It will most probably be a decade or so before the number of video compression units in use exceed the number of

analog descramblers which would benefit from the Decoder Interface Connector. Even at that time, the analog descramblers will continue in use for an extended period of time. Accordingly, the promise of digital compression is not a reason to shy away from a Decoder Interface Connector implementation which will help tens of millions of subscribers for more than a decade. Since video compression and HDTV are both digital, the Decoder Interface developed for HDTV will work for video compression as well.

4. Implementation. It is likely that the number of homes which would benefit from the availability of EIA/ANSI 563 equipped TVs and VCRs will increase substantially over the next few years. This does not mean that EIA/ANSI 563 solves all problems or even that it has reached the full potential of the concept. On the contrary, there are numerous potential improvements which can increase the utility of both consumer electronics products and cable services. The EIA/NCTA Joint Engineering Committee should commence development of these advanced standards. They should, however, be done in a "backwards compatible" manner so that existing products and those still in production are not disadvantaged. A standard is said to be "backwards compatible" if it retains compatibility with older units when it is upgraded to accommodate new technology. The EIA has a long history of such compatible upgrades of standards.

EIA/ANSI 563 should be implemented as soon as possible. Simultaneously, the Joint Engineering Committee should begin work

on defining backwards compatible advanced versions. These will probably be called EIA/ANSI 563A, B, C, etc. just as other standards have suffix versions (such as the computer peripheral EIA standard RS 232C). This approach allows consumers to benefit from standards while providing for future upgrades. A time delay, perhaps of two years, should be allowed for implementing the next version of EIA/ANSI 563 from the date of adoption by the two industries of the upgraded standard and its endorsement by ANSI.

Priority upgrades to be considered for EIA/ANSI 563 might include:

- Mandate that the remote control signal pass through to the decoder.
- Enable the descrambler to "force-tune" the TV's or VCR's tuner to the correct channel to facilitate functions such as access to NVOD, Emergency Alert, or pre-ordered pay-per-view programs.
- The addition of an intermediate frequency ("IF") output from TVs and VCRs to accommodate scrambling systems which operate directly on the carrier of the signal. This upgrade would satisfy that market segment while also beginning the evolution towards products which will work with digital video compression modules.

While these upgrades are highly desirable because they provide economies and simplifications, they are not essential. The communication of infrared signals to the EIA/ANSI 563 decoder could be achieved with an infrared detector on a short wire placed where it can "see" the emissions of the hand held remote control. Likewise, functions such as forced-tuning of channels can be achieved with an "IR Blaster" wired to the EIA/ANSI 563

descrambler. Both of these techniques are commonly used in consumer electronics products. Universal remote controls can be provided which simultaneously control the TV, VCR, and provide the right signals for the cable functions.

To be successful, implementation of the Decoder Interface Connector requires the cooperation of consumer electronics manufacturers, cable operators, and cable descrambler manufacturers. The Decoder Interface Connector has suffered from a lack of patience. A few years ago a number of TV manufacturers, RCA in the largest volumes, produced receivers with Decoder Interface Connector plugs. A number of cable box manufacturers, Zenith most notably, produced Decoder Interface Connector descramblers. Several cable companies stocked and supplied Decoder Interface Connector decoders to those who requested them. Only Bang & Olufsen produced VCRs with the Decoder Interface Connector.

At that time the numbers were just too small and the patience too thin. The participants lost heart and gave up. The compatibility of the consumer electronics equipment with cable technology was not as well appreciated as it is now. At this point, each of the participants need assurance that the other two will do their share. This might best be accomplished with a legal requirement to implement that gives comfort that progress <u>will</u> be made. In particular, as explained in greater detail in the following section, Time Warner urges that any TV or VCR which is marketed as "cable ready" must, among other things, be

equipped with the EIA/ANSI 563 decoder interface. In return, the cable industry should be required to provide a component descrambler to any subscriber selecting encrypted cable services who has a TV or VCR equipped with the EIA/ANSI 563 decoder interface. Such component descrambler should be made available at a monthly rental cost to the subscriber not to exceed any similar charges imposed for the integrated converter/descrambler offered by the system.

Those who are worried about possible business disruptions should take comfort in the fact that the sales of TVs and VCRs takes place at a steady and deliberate pace. The requirement to provide the Decoder Interface Connector will not change any business overnight. It will, however, provide an option for the consumer who wishes the ultimate cable-friendly installation and is in the market for a new TV or VCR. That is something that is available now in very limited form with Bang & Olufsen TVs and VCRs and a few hundred EIA 563 decoders left in cable system inventories.

It is important to recognize that a Decoder Interface Connector equipped TV or VCR which suffers from the other deficiencies such as DPU interference will still require a set-top converter. The benefits of the Decoder Interface Connector will be lost if the TV receiver or VCR fails the other requirements for being truly "cable ready."